that tides exist in the solid masses, which are of a viscous and not an elastic character. If tides are raised in a viscous body the protuberances are carried past the line joining the centers of the bodies and the differential pull on the protuberances acts as a brake on the motions of the system. The resulting effect is to slow down the rate of rotation and increase the distance between the two bodies. The tidal theory of the evolution of the moon depends chiefly on the assumption that such tides exist in the earth. The results of this experiment show that the earth-moon system has not undergone the evolution supposed by Darwin unless the interior conditions were formerly vastly different from what they are at present.

Professor Moulton's calculations show that if the ratio of the observed to the calculated tides is taken as 0.70 and the acceleration of phase as the mean of the E.–W. and N.–S., *i. e.*, 1.8 minutes, the mean rigidity of the earth is about 8.6×10^{11}, and the viscosity is 10.9×10^{16}, in C.G.S. units. These are of the order of magnitude of the rigidity and viscosity of steel. These calculations assume that the distortion decreases in geometrical progression as the time increases in arithmetical progression, and that the substance of the earth is homogeneous, a condition which does not, of course, exist. We may say, however, that the earth tides are approximately what they would be if the earth, through and through, had the properties of ordinary steel.

It would be a matter of very great interest to have similar series of observations taken at various places on the earth. Professor Chamberlin is very hopeful that the whole problem of ocean tides, now so intricate and apparently insolvable, may yield to investigations conducted along lines which take account of the joint action of the water tide and body tide. There can be no doubt, as he has pointed out, that the tides in many places are largely influenced by the rocking of the basins. It would be necessary to conduct a number of investigations like the one herein described in different regions to give definite knowledge of the facts as to the amount of the body tide, together with an ample series of inspections of the basins of the great water bodies. Professor Chamberlin also believes that we should have further investigations of this kind on account of their bearing on vulcanism and seismic disturbances. These phenomena are almost certainly connected with the elastic state and degree of rigidity of the earth-body and of its different parts.

It is Professor Michelson's intention to install an automatic recording device, and to continue the observations at Yerkes Observatory by interference methods. A considerably higher degree of precision is expected.

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EDUARD SUESS

EDUARD SUESS, dean of modern geology and geologists, passed away on April 26, 1914, in the fullness of his eighty-three years, revered by all students of his chosen earth science and loved by all who came under the influence of his warm personality.

The son of a German merchant of Jewish extraction, Suess was born in London on August 20, 1831. Here his parents resided until 1834, when they removed to Prague, and eleven years later to Vienna, where the youth was destined to rise to great eminence in the university, in the council of the city, and in the Austrian parliament. Suess was born and lived in an environment that made of him a great linguist, and during a period of his life it is said that he acquired a new language each year. Certain it is that he was at home in many tongues; and more than once, on receiving one of his characteristic letters, has the writer noted the ease with which he expressed his thoughts in English.

While in the Polytechnic School, it became apparent that Suess's natural bent was wholly toward natural history studies, and at nineteen years of age he published his first paper, a short sketch of the geology of Carlsbad and its mineral waters. In 1851 he was appointed as assistant in the geological department of the Royal Natural History Museum at Vienna, where for the next eleven years he devoted

himself to paleontology, and chiefly to brachiopods of the Paleozoic and Mesozoic eras. The comprehensiveness of his mind evinced itself even in these early years, for in 1859 and 1860 appeared a little book of 122 pages, entitled "Die Wohnsitze der Brachiopoden," in which he examines the living species, seventy-six in number, and from this draws certain conclusions as to the probable habitats of the fossil forms.

At the age of twenty-four he married the daughter of Dr. Strauss, a distinguished physician in Prague, and, as has been said by Geikie, "entered on a life of great domestic happiness, which largely contributed to the success of a strenuous career wherein science and politics came to be strangely blended."

Geikie says further:

From his youthful days, when he described the Carlsbad springs, he had been interested in underground waters, and among the inquiries which he pursued while attached to the museum was one that embraced the relations of the soil and water supply of Vienna to the life of its inhabitants. In 1862 he published a small volume on this subject, in which he gave a comprehensive account of the economic geology of the district. At that time the city was suffering from an impure water supply and consequent typhoid fever. The luminous essay of the young professor at once attracted attention. He was the same year elected into the town council, that he might give the benefit of his advice in the steps to be taken towards the attainment of better sanitary arrangements. He boldly advocated a scheme for bringing the abundant pure water of the Alps into Vienna by means of an aqueduct 110 kilometers in length. This project, eventually adopted, was brought to a successful termination in 1873. So grateful were his fellow-citizens for the signal service thus conferred on them that they bestowed on him their highest civic distinction by electing him an honorary burgess. By this time he had made his mark in the town council as one of its most useful and able members, so that it was not surprising that he should have been chosen as one of the parliamentary representatives. For more than thirty years he sat in the Austrian parliament as a powerful leader of the Liberal party, only retiring in 1896, when advancing age made the strain of the two-fold life as a politician and man of science too great to be longer borne.

As a geologist and a member of parliament, it was natural for Suess to be deeply interested in the future supply of the monetary metals, gold and silver. He writes:

Some years after the introduction of the gold standard in Germany, I published, in 1877, a small work, "Die Zukunft des Goldes," wherein I tried to show that from geologic indications we must expect in the future a scarcity of gold and an abundance of silver, and that the extension of the gold standard to all civilized states is impossible.

In 1892 he published his "Die Zukunft des Silbers," and this work was so well thought of that an English translation was ordered and with the author's consent was published in 1893 by the finance committee of the United States Senate. At that time his predictions were being verified; gold was becoming scarcer, and silver kept on increasing in quantity in spite of its falling price. He says:

Under these circumstances many of my friends and myself were of the opinion that Austria-Hungary, in order to guard herself against all contingencies, ought indeed gradually to acquire a moderate amount of gold, but ought neither to proclaim a gold standard nor establish a definitive ratio between the silver florin and the gold coin.

At the age of twenty-six, Suess was appointed professor extraordinary and in 1867 was promoted to full professorship in the University of Vienna, and for forty-four years he remained a great and enthusiastic teacher, retiring with the title emeritus at the age of seventy. Among his students may be mentioned Neumayr, Mojsisovics, Fuchs, Waagen and Penck.

The greater part of Suess's long life was devoted to working out the evolution of the features of the earth's surface. The problem of mountain-building presented itself to his mind during his many excursions in the eastern Alps, and in 1875 he stated his views thereon in the small volume called "Die Entstehung der Alpen," an octavo of 168 pages. Up to this time his publications numbered sixty titles, his studies having ranged over nearly all the branches of geology.

"Die Entstehung der Alpen," to quote again from Geikie,

contains the germ of those later contributions to science which have placed him on so conspicuous an eminence among the geologists of the day. It sketches the general principles of mountain-architecture, especially revealed by a study of the Alpine chain. But he did not confine his view to the particular area with which he was himself personally familiar. Already his eye looked out on the wider effects of the unequal contraction of the terrestrial crust, and swept across the European continent eastward into Asia, and westward across the Atlantic into America. . . . To thoughtful students of the science this treatise, in his firm hold of detail combined with singularly vivid powers of generalization, was full of suggestiveness. But the interest and importance of its subject did not obtain general recognition until it was followed ten years afterwards (1885) by the first volume of the great "Antlitz der Erde"—the work which has chiefly given Suess his place among his contemporaries, and by which his name will be handed down to future time. In its striking arrangement of subjects, in its masterly grouping of details which, notwithstanding their almost bewildering multiplicity, are all linked with each other in leading to broad and impressive conclusions, and in the measured cadence of its finer passages, the "Antlitz" may be regarded as a noble philosophical poem in which the story of the continents and the oceans is told by a seer gifted with rare powers of insight into the past.

The writer had the great pleasure of meeting Suess during the Ninth International Geological Congress held at Vienna in August, 1903. Tall and powerful, decisive and yet kind, his great head covered by the familiar soft felt hat, the man left an indelible impress upon my memory during the hour in which we talked of paleogeography, seas and barriers. To me the personal interview was memorable, but the great mental power and vivid imagination of the master mind naturally showed to better advantage at the farewell banquet given by the congress at the Hotel Continental on the evening of August 27. Tietze, presiding as president of the congress, gave the official farewell in French. Following him, and speaking in his own tongue, came Geikie, telling of his first visit to Vienna forty years since, and saying that of those he met at that time nearly all were gone excepting Suess, then a young man of great prominence, since known to all geologists through his masterly work "Das Antlitz der Erde." This reference to the time when Geikie and Suess—both of whom later became storm-centers in geology—were young, visibly affected the latter. Toward the end of the speaking he arose and with bowed head and in a low voice which increased to greater volume as he went on, he made in German a most eloquent appeal to geologists to rise to ever greater and better work. Unfortunately no one was at hand to take down what he said, and so after the dinner I asked him if he would be so kind as to put his speech in writing. This he did a few days later and a translation of it appeared in the *American Geologist* for January, 1904. In part this is as follows:

> Returning to his earth the geologist perceives that the sum total of life's phenomena not only forms a single phenomenon, but that it is also limited by space and time. It occurs to him now that the stone which his hammer strikes is but the nearest lying piece of the planet, that the history of this stone is a fragment of the history of the planet, and that the history of the planet itself is only a very small part of the history of the great, wonderful, ever-changing Kosmos.
>
> His heart then thrills; he feels called as a co-laborer on the most sublime problems in which feeble mortal beings can take part. Then, too, he sees that the fundamental lines of structure coursing over the earth's surface have nothing to do with the political lines separating the nations. The vastness of the problem itself makes the concord of civilized nations natural, and they remain separated only through their emulation, all filled with the idea that mankind in general will most highly esteem that nation which is in the position to offer the most and the best of noble example, of new truth and of ideal worth.

CHARLES SCHUCHERT
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SCIENTIFIC NOTES AND NEWS

SURGEON GENERAL W. C. GORGAS has received the degree of doctor of laws from Yale University and from Princeton University.

THE degree of LL.D. was bestowed by the University of California on commencement day on Eugene Woldemar Hilgard, from 1874